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A new endemic insular species of the genus *Colubroelaps* (Squamata, Serpentes, Colubroidea) from Khanh Hoa Province, Vietnam

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Abstract

A new species of the poorly known genus *Colubroelaps* Orlov, Kharin, Ananjeva, Nguyen & Nguyen, 2009, is described based on a single female specimen collected from Hon Tre Island, Khanh Hoa Province, Vietnam. The new species, *Colubroelaps adleri* **sp. nov.**, can be distinguished from its sister species *Colubroelaps nguyenvansangi* Orlov, Kharin, Ananjeva, Nguyen & Nguyen, 2009 by the following combination of morphological characters: small body size (TL 402 mm); tail relatively short (ratio TaL/TL 0.10); dorsal scales in 14–14–14 rows; supralabials six, third and fourth entering orbit; infralabials seven; loreal present; ventral scales 234; subcaudals 30, all divided; cloacal plate divided; dorsal coloration pale brown, with narrow and interrupted dark stripe along spine; body flanks dark-gray lacking bluish iridescence; ventrally uniform off-white; head black with rostral, nasals, prefrontals, preoculars, loreal, and the two anterior supralabials, as well as anterior parts of supraoculars and frontal dirty yellowish-brown with dark-brown spots. This discovery represents the second known species of the genus *Colubroelaps* and the first record of the genus in the coastal areas of southern-central Vietnam. The new species is likely micro-endemic to the small island of Hon Tre within Nha Trang Bay in Khanh Hoa Province, Vietnam, at an elevation of 30 m a.s.l., and was recorded only from the heavily disturbed secondary forest area of the island. The new species is under threat due to the intensifying development of tourist infrastructure on Hon Tre Island. We suggest that the new species be considered Endangered (EN) following the IUCN's Red List categories.

Key Words

Colubroelaps adleri sp. nov., conservation, Hon Tre Island, morphology, Nha Trang Bay, taxonomy

Introduction

The monotypic genus *Colubroelaps* Orlov, Kharin, Ananjeva, Nguyen & Nguyen, 2009, is one of the most mysterious groups of snakes. This genus, colloquially known as lace snakes (Poyarkov et al. 2023), remained unnoticed for over a century of herpetological exploration of Vietnam and was only recently erected by Orlov et al. (2009). In its original description, the genus *Colubroelaps* was morphologically characterized as a small, very thin colubrid snake "with elapsoid morphotype but no fangs and venomous glands" (Orlov et al. 2009); body vermiform, round in cross section, total length up to 500 mm; small head roundish and short, not distinguished from the body, slightly dorso-ventrally depressed and covered by large regular shields; eyes very small with a round pupil; dorsal scales uniform, rhomboid, tile-shaped, smooth; the number of scale

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rows around the body is almost equal along all the body length; cloacal plate divided; maxillae slightly arched, longer than palatinum and hardly shorter than pterygoideum; palatinum with external process, joined with internal process of maxillae; pterygoideum with triangular hollow for palatinum; accordingly, palatinum has triangular projection for pterygoideum in its lower part; hypapophyses on the posterior trunk vertebrae, a diastema, and sulcate teeth on the posterior end of the maxillae are absent (cited from Orlov et al. 2009 with minor edits). In the original description, the genus was provisionally included in the family Colubridae Oppel, 1811, with the remark that the morphometric and scalation characters indicate similarities to both Colubridae and Elapidae Boie, 1827 snakes (Orlov et al. 2009). However, Zaher et al.'s (2019) subsequent examination of the skull morphology using micro-CT X-ray scanning demonstrated that *Colubroelaps* has hinged teeth more similar to those of the family Sibynophiidae Dunn, 1928 than to colubrids or elapids. The assumption by Zaher et al. (2019) that *Colubroelaps* was incorrectly assigned to the family Colubridae by Orlov et al. (2009) and should be regarded as a member of Sybinophiidae is now widely accepted (Uetz et al. 2024). However, any phylogenetic data on *Colubroelaps* are still unavailable; therefore, herein we follow Poyarkov et al. (2023) and take a cautious approach and refer to the taxon as a member of Colubroidea incertae sedis pending further phylogenetic assessment.

Currently, the genus *Colubroelaps* is only known for a single species named *C. nguyenvansangi* Orlov, Kharin, Ananjeva, Nguyen & Nguyen, 2009. The Nguyen Van Sang's lace snake was described based on a single adult female collected in 2003 from the Loc Bac Forest Enterprise, Bao Lam District, Lam Dong Province, southern Vietnam. Because of its fossorial lifestyle, this species is quite elusive and difficult to detect in the field. Until today, *C. nguyenvansangi* has only been reported from six localities in southern Vietnam, namely, Loc Bac and Di Linh districts in Lam Dong Province, Bu Gia Map National Park and Bu Dang District in Binh Phuoc Province, Tuy Duc District in Dak Nong Province, Buon Ma Thuot City and Krong Buk District in Dak Lak Province, and Cat Tien National Park in Dong Nai Province (see Nguyen et al. 2024, Fig. 1). Moreover, the occurrence of this species in eastern Cambodia is anticipated (Orlov et al. 2009; Poyarkov et al. 2023; Nguyen et al. 2024). The recent analysis of distribution and climatic niche modeling by Nguyen et al. (2024) demonstrated that *C. nguyenvansangi* is associated with seasonally dry, semi-deciduous, lowland, and mid-elevation tropical forests of southern Vietnam (see Vassilieva et al. 2016), and its distribution is restricted to the western foothills of the Langbian Plateau (see Fig. 1).

Khanh Hoa Province is located in the southern part of the coastal region of Vietnam and currently harbors 176,382 ha of evergreen forest (Anonymous, 2023). However, the biodiversity of this province is still poorly studied, in particular the herpetofauna. Ten new species were recently described with their type localities from Khanh Hoa Province within the last fifteen years, namely: *Kalophrynus honbaensis* Vassilieva, Galoyan, Gogoleva & Poyarkov, 2014; *Kurixalus viridescens* Nguyen, Matsui & Hoang, 2014; *Acanthosaura murphyi* Nguyen, Do, Hoang, Nguyen, McCormack, Nguyen, Orlov, Nguyen & Nguyen, 2018; *Cyrtodactylus cucdongensis* Schneider, Phung, Le, Nguyen & Ziegler, 2014; *C. raglai* Nguyen, Duong, Grismer & Poyarkov, 2021; *C. yangbayensis* Ngo & Chan, 2010; *Gekko truongi* Phung & Ziegler, 2011; *Sphenomorphus yersini* Nguyen, Nguyen, Nguyen, Orlov & Murphy, 2018; *Lycodon anakradaya* Nguyen, Duong, Wood & Grismer, 2022; and *L. truongi* Nguyen, Duong, Wood & Grismer, 2022 (see Poyarkov et al. 2021, 2023; Uetz et al. 2024). These discoveries, along with the complex terrain of the Khanh Hoa Province covering several isolated mountain systems and a number of offshore islands, suggest that this area may still harbor unrecognized herpetofaunal diversity.

During our recent field surveys on Hon Tre Island in Nha Trang Bay, Khanh Hoa Province, we encountered a specimen of *Colubroelaps* sp. that was superficially similar to *C. nguyenvansangi* in its overall morphological habitus and body coloration. Closer morphological examination of scalation, pattern, color, and morphometric characteristics of the Hon Tre specimen demonstrated clear morphological differences from *C. nguyenvansangi* in a number of taxonomically important traits. Therefore, in the present paper, we describe the *Colubroelaps* population from Hon Tre Island as a new species.

Materials and methods

Sampling

Fieldwork was carried out in Hon Tre Island within Nha Trang Bay, Khanh Hoa Province, Vietnam, by N. A. Poyarkov and A. M. Bragin from 15 to 20 of June 2023 (Fig. 1, locality 1). We obtained geographic coordinates and altitude using a Garmin GPSMAP 60CSx GPS receiver (USA) and recorded them in datum WGS 84. The specimen was collected by hand, photographed in life, and euthanized using MS-222 solution within 24 h after capture. The specimen was fixed in 4% buffered formalin for 24 h and later stored in 70% ethanol. The specimen was subsequently deposited in the herpetological collection of the Zoological Museum of Moscow State University (ZMMU), Moscow, Russia. Specimen collection and animal use protocols were approved by the Institutional Ethical Committee of the Joint Vietnam-Russia Tropical Science and Technology Research Center (VRTC). Fieldwork in Hon Tre Island, including collection of animals in the field, was authorized by the People's Committee of Khanh Hoa Province, Vietnam (#5565/UBND-KT of 08.06.2023) granted to VRTC. Abbreviations. **Mt.**: Mountain; **NP.**: National Park; **Isl.**: Island; **asl.**: above sea level.

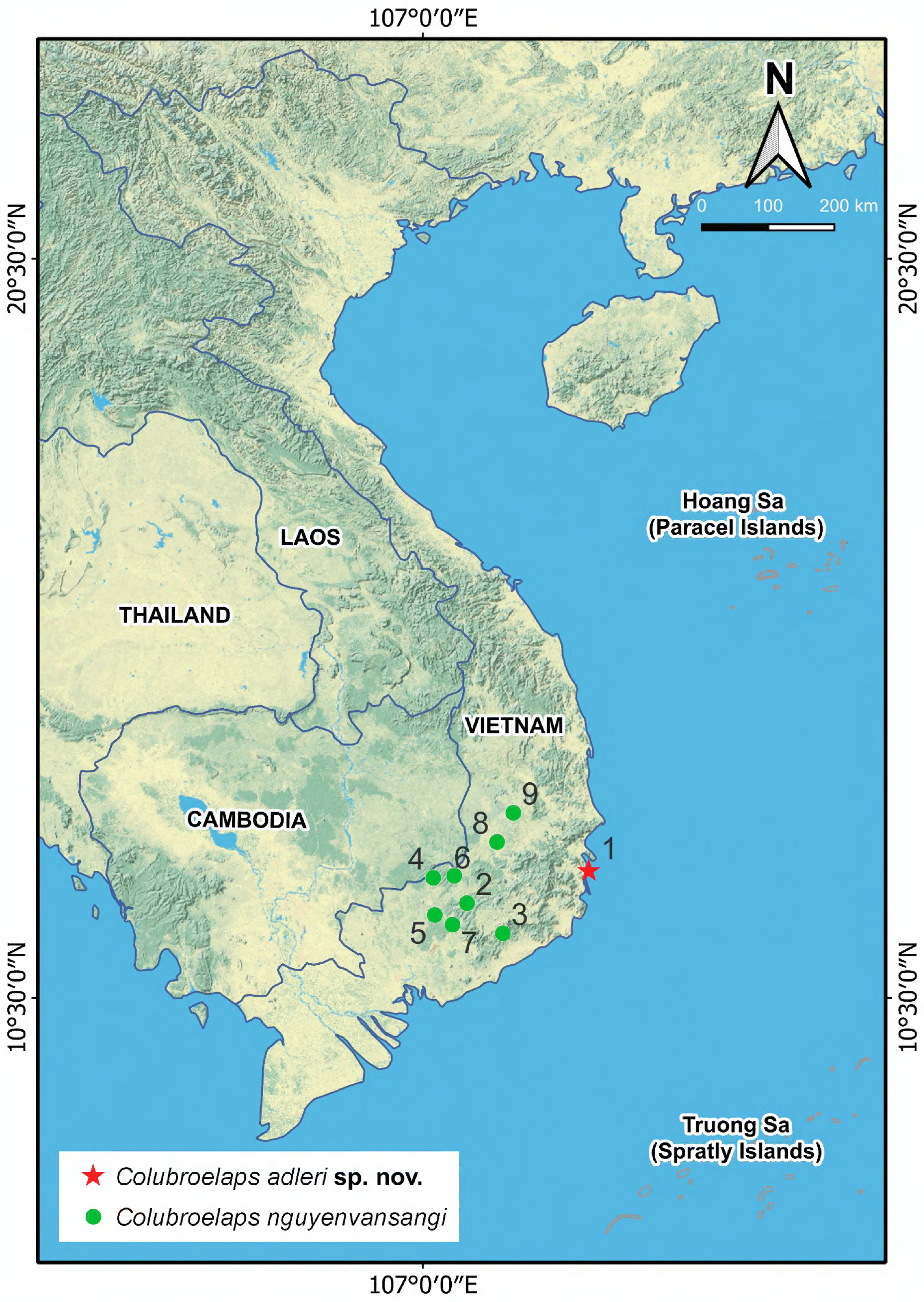

Figure 1. Distribution of the genus *Colubroelaps* in Vietnam. Localities**:** *Colubroelaps adleri* sp. nov. (red): (1) Hon Tre Island within Nha Trang Bay, Khanh Hoa Province (type locality); *C. nguyenvansangi* (green): (2) Loc Bac, Lam Dong Province (type locality); (3) Di Linh, Lam Dong Province; (4) Bu Gia Map NP, Binh Phuoc Province; (5) Bu Dang, Binh Phuoc Province; (6) Tuy Duc, Dak Nong Province; (7) Cat Tien NP, Dong Nai Province; (8) Buon Ma Thuot, Dak Lak Province; (9) Krong Buk, Dak Lak Province.

Morphological differentiation

Measurements and meristic counts followed Orlov et al. (2009) and Poyarkov et al. (2019, 2022). We presented the paired meristic characters in left/right order. We used a Mitutoyo digital caliper to take the following measurements to the nearest 0.1 mm: **ED**, horizontal eye diameter; **HD**, maximum head depth; **HL**, head length (from the tip of rostral to the posterior end of the jaw); **HW**, maximum head width; **SnL**, snout length (from the tip of rostral to the anterior eye margin); **SVL**, snout-vent length; **TaL**, tail length; **TL**, total length. The following meristic characters were examined: **ASR**, anterior number of dorsal scale rows (at one HL behind the head); **IL**, number of infralabial scales; **MSR**, number of dorsal scale rows at midbody (counted at the level of the middle of the distance between the snout tip and the cloaca); **PO**, number of postoculars; **PrO**, number of preoculars; **Lor**, number of loreals; **AT**, number of anterior temporals; **PT**, number of posterior emporals; **PSR**, posterior number of dorsal scale rows (at one HL before the cloacal plate); **PreV**, number of preventrals (scales directly preceding the ventrals, unpaired, wider than long but not in contact on each side with the 1st dorsal scale row); **SC**, number of subcaudal scales, not including the terminal pointed scute; **SL**, number of supralabial scales; **VEN**, number of ventral scales (counted following Dowling 1951). We determined the sex by examining the cloacal area for the presence of hemipenis and performing minor dissections of the body.

We conducted a detailed comparison of the morphological and coloration characters of the examined specimen with three available specimens of *C. nguyenvansangi*, including the holotype ZISP 25682, reported by Orlov et al. (2009) and stored in the Zoological Institute, Russian Academy of Sciences, St. Petersburg, Russia (ZISP), and two additional specimens from the herpetological collection of ZMMU. The morphological data for all examined specimens is presented in Table 1.

Results

Our morphological analysis, which recovered a number of important diagnostic characters summarized below, allows unambiguously distinguishing the population of *Colubroelaps* sp. from Khanh Hoa Province from *C. nguyenvansangi*. These results support our hypothesis that this recently discovered lineage of *Colubroelaps* sp. from Khanh Hoa Province represents a previously unknown species, which we formally describe below.

Colubroelaps adleri sp. nov.

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Table 1, Figs 2, 3A–C, 4A

Holotype. • ZMMU Re-18000 (field tag NAP-15227), adult female, collected by Nikolay A. Poyarkov and Andrey M. Bragin on June 17, 2023, from Dam Bay Research Station, Hon Tre Island, within Nha Trang Bay in Vinh Nguyen Ward, Nha Trang City, Khanh Hoa Province, Vietnam (12.198°N, 109.289°E; at the elevation of 30 m asl.).

Diagnosis. *Colubroelaps adleri* sp. nov. can be distinguished from *C. nguyenvansangi* by the following combination of morphological characters: body size small (TL 402 mm); tail relatively short (ratio TaL/TL 0.10); dorsal scales in 14–14–14 rows; supralabials six, third and fourth entering orbit; infralabials seven; loreal present; ventral scales 234; subcaudals 30, all divided; cloacal plate divided; dorsal coloration pale brown with narrow and interrupted dark stripe along spine; body flanks dark gray lacking bluish iridescence; ventrally uniform off-white; head black with rostral, nasals, prefrontals, preoculars, loreal, and the two anterior supralabials, as well as the anterior parts of supraoculars and frontal shields dirty yellowish-brown with dark brown spots.

Description of the holotype. Adult female specimen in a good state of preservation (Fig. 2). Body strongly elongated, very thin, vermiform, round in cross-section. Tail obtusely rounded, comparatively short, the tip of tail blunt (SVL 362 mm; TaL 40.2 mm; TL 402.2 mm; ratio TaL/TL 0.10) (Fig. 2E–G). Head very small, rounded, slightly dorso-ventrally depressed, covered by large, regular, symmetric shields (Figs 2A–D, 3A–C), not distinct from the neck (HL 7.99 mm; HW 5.16 mm; ratio HW/HL 0.65). Snout wide, short, bluntly rounded in dorsal view (Fig. 2A, B), slightly tapering in lateral view (Fig. 2C, D). Rostral barely visible in dorsal aspect, triangular (Figs 2A, 3A). Eyes very small with round pupils (ED 0.51 mm, EN 1.46 mm, SnL 2.78 mm) (Fig. 2C, D). Single nasal on each side of head (1/1 nasals); nostril oval-shaped, with horizontal orienatation, completely enclosed in nasal scale, located closer to the posterior edge of nasal (Figs 2C, D, 3B); single (1/1) loreal, small, almost triangular in shape, shorter than the eye diameter, in contact with nasal, 1st and 2nd supralabial, preocular, prefrontal and internasal; single (1/1) preocular, large, elongated pentagonal in shape, subequal to the eye diameter, in contact with 2nd and 3rd supralabial, the orbit, supraocular, prefrontal and loreal; single (1/1) postocular, trapezoidal in shape, smaller than the eye diameter, in contact with 4th supralabial, parietal, supraocular and the orbit; single (1/1) supraocular, large and wide, ca. twice longer than the eye diameter, in contact with the orbit, postocular, parietal, frontal, prefrontal and preocular (Figs 2C, D, 3B). Six supralabials on each side of the head (6/6), fourth one the largest, third and fourth supralabials in contact with eye, posterior edge of fourth supralabial in contact with anterior temporal, separating fifth supralabial from parietal; fourth supralabial in contact with parietal, postocular, and anterior temporal (Figs 2C, D, 3A); seven (7/7) infralabials, the anterior-most pair in contact with each other behind the mental (Figs 2B, 3C); the first four pairs of infralabials in contact with the anterior pair of chin shields (Figs 2B, 3C); fourth and fifth infralabials in contact with the poste-

Table 1. Morphological data on the type series of *Colubroelaps adleri* sp. nov. and *C. nguyenvansangi*; diagnostic differences from the new species are marked in bold. **Notes**: for abbreviations, see the Materials and methods section; "*": data on the holotype of *C. nguyenvansangi* as reported by Orlov et al. (2009), when different from our observations.

Species	***Colubroelaps adleri* sp. nov**		***C. nguyenvansangi***	
Collection number	**ZMMU Re-18000**	**ZISP 25682**	**ZMMU Re-15484**	**ZMMU Re-15485**
Type status	Holotype	Holotype	—	—
Locality	Dam Bay, Hon Tre Isl., Khanh Hoa Prov., Vietnam	Loc Bac, Bao Lam Dist., Lam Dong Prov., Vietnam	Bu Gia Map NP., Binh Phuoc Prov., Vietnam	Cat Tien NP., Tan Phu Dist., Dong Nai Prov., Vietnam
Sex	Female	Female	Male	Male
SVL (mm)	362	393	399	368
TaL (mm)	40.2	**107**	**121**	**98**
TL (mm)	402	**500**	**520**	**466**
TaL/TL	0.10	**0.21**	**0.23**	**0.21**
HL (mm)	8.0	5.9	5.9	5.5
HW (mm)	5.2	4.3	4.3	4.0
SnL (mm)	2.8	2.0	2.4	2.1
ED (mm)	0.5	0.8	1.0	0.8
EN (mm)	1.5	1.2	1.2	1.1
IO (mm)	3.0	2.7	2.8	2.5
SL	6/6	6/6	6/6	6/6
IL	7/7	7/7 (6/6)*	7/7	7/7
PrO	1/1	1/1	1/1	1/1
PO	1/1	1/1	1/1	1/1
Lor	1/1	1/1 (0/0)*	1/1	1/1
AT	1/1	1/1	1/1	1/1
PT	2/2	2/2	2/2	2/2
ASR	14	**16**	**16**	**16**
MSR	14	**16**	**16**	**16**
PSR	14	**16**	**16**	**16**
VEN	234	**267**	**282**	**292**
SC	30	**81**	**87**	**86**
Cloacal plate	divided	divided	divided	divided
Dorsal color and pattern	light brown with interrupted dark stripe along spine	**reddish-brown with continuous stripe along spine**	**reddish-brown with continuous stripe along spine**	**reddish-brown with continuous dark stripe along spine**
Pattern in the anterior part of head	dirty yellow-brown, narrow	**uniform light yellow or white, wide**	**uniform light yellow or white, wide**	**uniform light yellow or white, wide**

rior pair of chin shields (Figs 2B, 3C). Three gular scales aligned between the chin shields and the first preventral (Figs 2B, 3C). One pair of enlarged internasals, in contact with each other; one pair of enlarged prefrontals, in contact with each other; one wide, pentagonal frontal shield; one pair of wide, triangular parietals, in contact with each other, anteriorly separated by the protruding posterior edge of frontal (Figs 2A, 3B), posteriorly barely extending beyond posterior edges of upper posterior temporals (Fig. 3B). Single (1/1) anterior temporal, quadrangular in shape; two (2/2) posterior temporals, lower one the largest, two and a half times larger than upper posterior temporal (Fig. 3A, B), upper one rectangular-shaped, narrow, notably protruding beyond the upper edge of lower posterior temporal (Figs 2C, D, 3B), in dorsal aspect notably protruding beyond the posterior edge of parietal (Fig. 3B). Dorsal scales in 14–14–14 rows. Dorsal scales rhomboid, tile-shaped, all smooth, and of the same size (Fig. 2G). Ventrals 234; cloacal plate divided (Fig. 2E); 30 subcaudals, all divided (Fig. 2E, F).

Coloration in life. Body glossy but lacking the metal/bluish iridescence (Figs 2A–G, 4A). Dorsal background coloration pale brown, with narrow and interrupted dark stripe along spine (Figs 2G, 4A), formed by small, ca. 1 scale in size, dark brown to black, diamond-shaped blotches (Fig. 2A); body flanks dark gray, nearly black, with indistinct light gray mottling along the scale edges; ventral surface of body and tail off-white with light greenish tint (Fig. 2E, F). Head black to dark brown with rostral, nasals, prefrontals, preoculars, loreal, the first two supralabials, as well as the anterior part of supraoculars and frontal shield dirty yellowish-brown with dark brown irregular spots (Fig. 2A–D). Ventral surfaces of the head white with chocolate-brown blotches (Fig. 2B). After one year in preservative, the background dorsal color faded to beige-gray, and yellowish parts faded to off-white; overall, the pattern of dark markings remained unchanged.

Comparisons. The main differences between the new species and *C. nguyenvansangi* are summarized in Table 1. *Colubroelaps adleri* sp. nov. can be easily distinguished from *C. nguyenvansangi* by having notably shorter tail (TaL/TL 0.10 in a single female vs. 0.21 in females and 0.21–0.23 in males; however, this character should be taken cautiously: the tail of *Colubroelaps adleri* sp. nov. holotype may be incomplete; cases of caudal autotomy were earlier reported for the members of Sibynophiidae and likely may also occur in *Colubroelaps*; see Mendelson, 1991), lower number of body scale rows (DSR 14–14–14 vs. 16–16–16); lower number of ventrals (VEN 234 in a single female vs. 267 in female, 282–292 in males); much lower number of subcaudals (SC 30 in a single female vs. 81 in female, 86–87 in males).

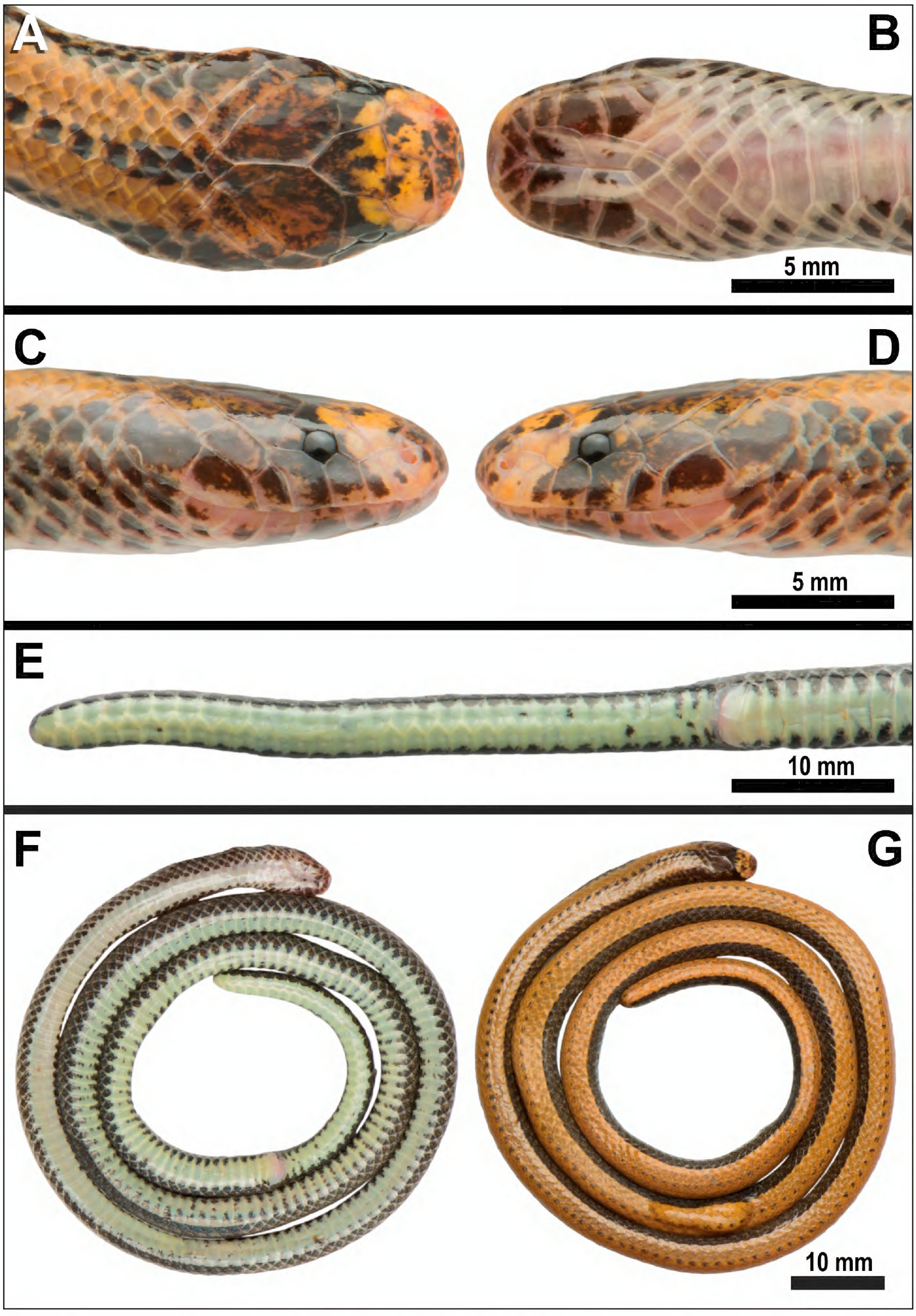

Figure 2. The holotype of *Colubroelaps adleri* sp. nov. in life (ZMMU Re-18000, adult female) from Hon Tre Island, Khanh Hoa Province, Vietnam. **A.** Dorsal view of the head; **B.** Ventral view of the head; **C.** Lateral view of the right side of the head; **D.** Lateral view of the left side of the head; **E.** Ventral view of the tail; **F.** Ventral view of the body; **G.** Dorsal view of the body. Scale bars: 5 mm (**A–D**); 10 mm (**E–G**). Photographs by A. M. Bragin.

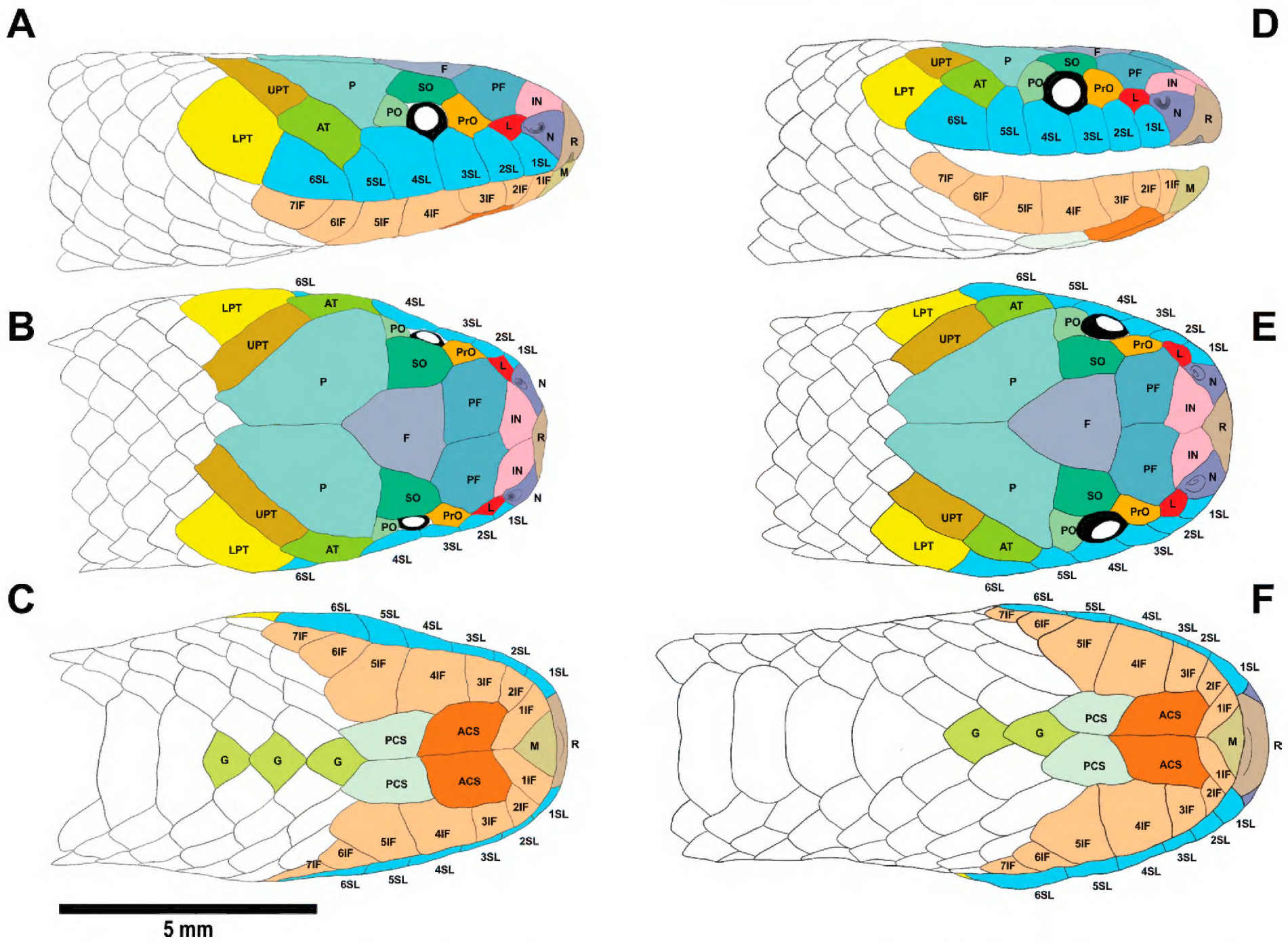

Figure 3. Line drawings of head scalation of the *Colubroelaps adleri* sp. nov. holotype (ZMMU Re-18000, adult female; **A–C**) and of the *C. nguyenvansangi* holotype (ZISP 25682, adult female; **D–F**). Line drawings show the head scales in lateral (**A, D**), dorsal (**B, E**), and ventral (**C, F**) aspects. Abbreviations: ACS = anterior chin shield; AT = anterior temporal; F = frontal; G = gular scale; IL = infralabial; IN = internasal; L = loreal; LPT = lower posterior temporal; M = mental; N = nasal; P = parietal; PCS = posterior chin shield; PF = prefrontal; PO = postocular; PrO = preocular; R = rostral; SL = supralabial; SO = supraocular; UPT = upper posterior temporal. Scale bar equals 5 mm. Line drawings by A. M. Bragin.

Furthermore, the new species can be easily diagnosed from *C. nguyenvansangi* by having three gular scales between the chin shields and the first preventral (vs. two) (Fig. 3C, F); by fourth infralabial in contact with parietal and anterior temporal, separating fifth infralabial from parietal and postocular (vs. fifth infralabial in contact with parietal and postocular) (Fig. 3A, D); by upper posterior temporal being elongated and much narrower than lower one, noticeably protruding beyond the level of the posterior edge of parietals (vs. upper posterior temporal small, as long as lower posterior temporal, not protruding beyond the level of the posterior edge of parietals) (Fig. 3A–E). *Colubroelaps adleri* sp. nov. can be further diagnosed from *C. nguyenvansangi* by having pale brown dorsum with narrow and interrupted dark stripe along spine (vs. reddish-brown dorsum with narrow and continuous dark stripe along spine) (Fig. 4A, B); by lacking the metallic iridescence on dorsum and body flanks (vs. body with bluish metallic iridescence) (Fig. 4A, B); and by having dirty yellowish-brown anterior part of head with irregular dark brown blotches (vs. uniform light yellow to white blotch on anterior part of head lacking dark markings) (Fig. 4A, B).

Etymology. The species epithet '*adleri*' is a patronymic adjective in genitive singular. We name the new species in honor of Dr. Kraig Adler, Professor Emeritus at Cornell University (New York, USA), in recognition of his outstanding support to the international herpetological community as well as his remarkable scientific contribution to Asian herpetology. We suggest the following common names for the new species: "*Adler's lace snake*" (in English), "*Shnurkovaya zmeya Adlera*" (Шнурковая змея Адлера, in Russian), and "*Rắn hổ nước Át-Lơ*" (in Vietnamese).

Distribution and natural history notes. Currently, *Colubroelaps adleri* sp. nov. is known only from a single locality in secondary dry maritime evergreen forest on Hon Tre Island, Khanh Hoa Province, South Central Coastal Region of Vietnam (Figs 1, 5). The new species is also expected to inhabit other islands of the Nha Trang Bay, though they are much smaller than Hon Tre, and on some of them, forest vegetation has been greatly destroyed. The only known specimen of *Colubroelaps adleri* sp. nov.

Figure 4. Two species of the genus *Colubroelaps* in life. **A.** *Colubroelaps adleri* sp. nov., holotype ZMMU Re-18000, adult female from Dam Bay Research Station, Hon Tre Island, Khanh Hoa Province, Vietnam; **B.** *Colubroelaps nguyenvansangi*, ZMMU Re-15485, adult male from Cat Tien NP., Tan Phu District, Dong Nai Province, Vietnam. Photographs by: A. M. Bragin (**A**); E. A. Galoyan (**B**).

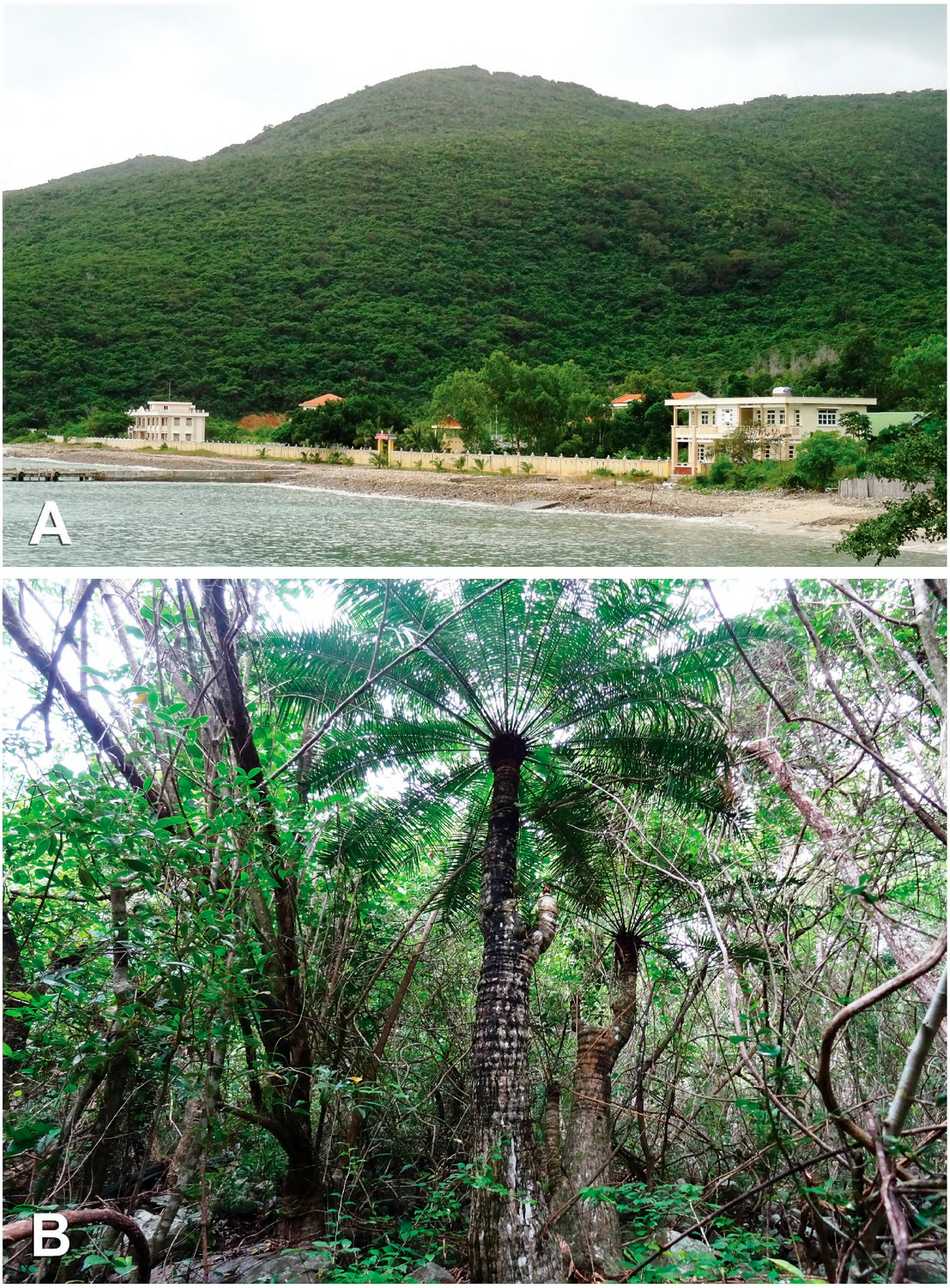

Figure 5. Habitat of *Colubroelaps adleri* sp. nov. **A.** Macrohabitat; **B.** Microhabitat of the new species in Dam Bay Research Station, Hon Tre Island, Nha Trang, Khanh Hoa Province, Vietnam. Photographs by A. V. Alexandrova.

was collected during the daytime (14h00) while crossing the road. The individual was collected near a garbage dump at the Dam Bay Research Station at 30 m a.s.l. elevation (Fig. 5A), ca. 10 m from a dry maritime mixed low evergreen forest. The forest near the type locality is dominated by *Buchanania reticulata* Hance, *Choerospondias axillaris* (Roxb.) Burtt. & Hill, *Pentaspadon annamense* (Evrard & Tardieu) Phạmh., *Spondias pinnata* (L.f.) Kurz, and *Ormosia* sp., including occasional trees of *Sindora siamensis* Teijsm. ex Miq., *Streblus ilicifolius* (S. Vidal) Corner, and *Eurya turfosa* Gagnep, and with an undergrowth formed primarily by *Dracaena* sp. and with occasional specimens of *Cycas rumphii* Miq. (Fig. 5B) (plant identification—A. N. Kuznetsov, pers. comm.). Other species of snakes recorded in sympatry with the new species at the type locality included *Lycodon davisonii* (Blanford, 1878), *L. capucinus* (Boie, 1827), *Ptyas korros* (Schlegel, 1837), *Ophiophagus hannah* (Cantor, 1836), and *Trimeresurus albolabris* (Gray, 1842).

A parasitic invasion of the Acanthocephala (Kölr.) worm was found in the subcutaneous cavity between the skin and the body muscles in the posterior third of the specimen length on its dorsal side (Figs 2C, 4A). The presence of this parasite may indicate that *Colubroelaps adleri* sp. nov. likely feeds on insects, as these animals are the intermediate hosts for acanthocephalan parasitic worms. All other aspects of the ecology of *Colubroelaps adleri* sp. nov., including information on diet, preferred microhabitats, reproduction, and predators, remain unknown.

Discussion

Orlov et al. (2009) described the new genus and species, *C. nguyenvansangi*, based on a single female specimen (ZISP 25682) collected from Lam Dong Province, Vietnam. To date, this species' rarity and elusive habits have largely prevented the publication of morphological data on additional specimens. In this study, based on re-examination of the female holotype as well as an examination of two additional male specimens, we, for the first time, provide data on morphological variation within *C. nguyenvansangi*. The additional materials examined include an adult male ZMMU Re-15484 from Bu Gia Map NP, Binh Phuoc Province, and an adult male ZMMU Re-15485 from Cat Tien NP., Dong Nai Province; the morphological data on the three specimens of *C. nguyenvansangi* is summarized in Table 1.

During the re-examination of the *C. nguyenvansangi* holotype (ZISP 25682), we found several inconsistencies contradicting its original description by Orlov et al. (2009). In particular, the holotype of *C. nguyenvansangi* clearly showed the presence of a loreal, same as in the other two specimens of *C. nguyenvansangi* examined by us (see Table 1, Fig. 3D, E). However, Orlov et al. (2009: 235) indicated that loreal is absent in ZISP 25682 but reported the presence of a posterior nasal in this specimen ("nostril large, situated between two nasals, more close to posterior edge of anterior nasal on the border with posterior nasal; no loreal," p. 235). We do not agree with this interpretation, as in all three *C. nguyenvansangi* specimens examined by us, the nostril was clearly completely enclosed within the undivided nasal scale (Fig. 3D, E). Therefore, we re-interpret the 'posterior nasal' scale of Orlov et al. (2009) as a loreal. Another inconsistency is that Orlov et al. (2009: 236) added a somehow contradictory statement regarding the number of supralabials in ZISP 25682: "supralabials 6–6, the 1st is the smallest and the 7th is the largest" (p. 236). After re-examination of the holotype specimen, we can confirm that ZISP 25682 indeed has 6/6 supralabials, the same as all other *C. nguyenvansangi* specimens examined by us (Table 1); therefore, this inconsistency is likely due to a typographic mistake. Furthermore, Orlov et al. (2009: 236) stated that *C. nguyenvansangi* has six infralabials ("there are 6–6 infralabial shields; the fourth and fifth are the largest," p. 236). Our re-examination of the holotype ZISP 25682 clearly indicates that it has 7/7 infralabials (Fig. 3D, F); this character is shared by all other *C. nguyenvansangi* specimens examined by us (Table 1). Finally, all three specimens of *C. nguyenvansangi* available for our examination had 16–16–16 dorsal scale rows, including the holotype, while Orlov et al. (2009: 235) stated that this specimen has 15–15–15 dorsal scale rows.

Therefore, based on re-examination of the holotype and examination of two additional specimens of *C. nguyenvansangi*, both males, we provide below a revised diagnosis for this species as follows: body size comparatively large (TL 466–520 mm in males, 500 mm in a single female), tail relatively long (TaL/TL ratio 0.21–0.23 in males, 0.21 in a single female); dorsal scales in 16–16–16 rows; supralabials six, third and fourth entering orbit; infralabials seven; loreal present; 1/1 nasal, nostril completely enclosed in nasal scale; ventral scales 282–292 in males, 267 in a single female; subcaudals 86–87 in males, 81 in a single female, all divided; cloacal plate divided; dorsally reddish-brown with narrow and continuous dark stripe along spine; flanks dark gray, nearly black with bluish iridescence; ventral surfaces bluish-white; head black with rostral, nasals, prefrontals, preoculars, loreal, and the two anterior supralabials and the anterior parts of supraocular and frontal shields uniform light yellow or white lacking dark markings.

Based solely on morphological characters, we have identified the Hon Tre specimen of *Colubroelaps* as a new species. Further molecular analyses are required to clarify the degree of genetic divergence between the two species of *Colubroelaps*, as well as to shed light on the phylogenetic position of this enigmatic genus within Colubroidea. *Colubroelaps adleri* sp. nov. occurs at low elevations of ca. 30 m asl. and appears to be restricted to the unique maritime dry evergreen forests of southern Vietnamese coasts, in contrast to its sister species *C. nguyenvansangi*, which occurs at elevations of 100–930 m asl. in lowland and mid-elevation seasonally dry monsoon semideciduous forests of southern Vietnam as defined by Poyarkov et al. (2021, 2023). To date, the new species, *Colubroelaps adleri* sp. nov., is known only from a sin-

gle specimen that was discovered during a herpetological survey in a very narrow area on a small offshore island within the Nha Trang Bay. This is a highly secretive snake that appears to have a fossorial lifestyle. Our intensive surveys in similar habitats over several other forested areas of the coastal region in central and southern Vietnam (Ba Ria-Vung Tau, Binh Thuan, Ninh Thuan, Khanh Hoa, and Phu Yen provinces) failed to discover any additional populations of *Colubroelaps*. Furthermore, the new species is likely affected by the growing anthropogenic pressure and forest destruction in Hon Tre Island due to the expanding construction of roads and tourism infrastructure. In particular, the recent development of the VinPearl Resort and the construction of the VinPearl Land amusement park, as well as the world's largest oversea cable car route, have led to an enormous growth in the number of tourists visiting the small island of Hon Tre. In 2023, VinPearl welcomed nearly 10,000 visitors a day (https://vietnamlife.asia/vinpearl-land-nha-trang/). The immense financial returns of tourism development largely outweigh concerns for biodiversity conservation; therefore, urgent measures have to be developed at the local and central government levels to protect the remaining patches of the maritime forests of Hon Tre Island. Moreover, due to its uniqueness and rarity, *Colubroelaps adleri* sp. nov. is also likely to become a target species for illegal pet trade. Considering the available information, we recommend that *Colubroelaps adleri* sp. nov. be classified as Endangered (EN) according to the IUCN's Red List categories (IUCN Standards and Petitions Subcommittee 2019). Given Hon Tre Island's small size and rapidly growing tourism infrastructure, the new species may actually be Vietnam's most endangered snake. Further research is urgently required to clarify the extent of *Colubroelaps adleri* sp. nov. distribution, natural history, and population trends, thereby facilitating the development of adequate conservation actions.

Our discovery of *Colubroelaps adleri* sp. nov. significantly expands the knowledge on the geographic distribution of the genus *Colubroelaps*, which is now for the first time recorded from the coastal areas of southern and central Vietnam (Fig. 1). The discovery of a new previously unnoticed species of the enigmatic genus *Colubroelaps* in coastal areas of southern and central Vietnam highlights the overlooked biodiversity and further underlines the importance of this area as a local center of herpetofaunal diversity and endemism (Poyarkov et al. 2021, 2023). Recent studies have reported on numerous new species of reptiles (e.g., Pauwels et al. 2018; Ngo et al. 2020; Ostrowski et al. 2020, 2021; Do et al. 2023; Kliukin et al. 2023; 2024; Ngo et al. 2023; Nguyen et al. 2023; Idiiatullina et al. 2024) and amphibians (e.g., Duong et al. 2018; Nguyen et al. 2018; Pham et al. 2020; Hoang et al. 2021; Gorin et al. 2023) from this region. Also, we would like to note that the remaining forest communities in coastal areas of Vietnam's southern and central coastal regions are under great threat of deforestation (Meijer 1973; De Koninck 1999; Laurance 2007; Meyfroidt and Lambin 2008). The discovery of *Colubroelaps adleri* sp. nov. further underlines the key importance of these unique coastal tropical forests for the conservation of herpetofaunal diversity in Southeast Asia. It is therefore critical to urgently conduct further comprehensive investigations and taxonomic studies on herpetofauna in this region to gain a deeper understanding of its biodiversity, especially the offshore islands, as they may be more vulnerable to antropogenic threats.

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